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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/870,881	05/30/2001	Douglas C. Watson	NIKOP002/PA0 327	8984

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EXAMINER
JOHNSTON, PHILLIP A

ART UNIT	PAPER NUMBER
2881	

DATE MAILED: 08/28/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	09/870,881	WATSON ET AL.	
	Examiner	Art Unit	
	Phillip A Johnston	2881	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *16 June 2003* .

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-32* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-32* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *30 May 2001* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11)☐ The proposed drawing correction filed on _____ is: a)☐ approved b)☐ disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12)☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____ .

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14)☒ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).

a) ☐ The translation of the foreign language provisional application has been received.

15)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____ .
4) ☐ Interview Summary (PTO-413) Paper No(s). _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: .

Detailed Action

Claims Rejection – 35 U.S.C. 103

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which the subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

2. Claims 1-32 are rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent No. 6,510,755 to Higuchi, in view of Lo, U.S. Patent No. 6,252,705 and in further view of Trost, U.S. Patent No. 5,784,925.

Higuchi (755) discloses an XY stage mechanism that comprises a Y slide shaft 2 penetrating through only one side surface of the wall surfaces of a vacuum chamber 1 for holding a stage base plate in a cantilevered manner, a Y air slide bearing 4 for guiding the Y slide shaft 2, an X air slide plate 5, a first air slide bearing 6 for supporting the X air slide plate 5, a coupling portion 8, and a second X air slide bearing 9 serving as the guide of the coupling portion 8, whereby, in a state where not only the Y slide shaft is floated up but also the X air slide plate and coupling portion are floated up, the XY stage is driven. See Abstract

Higuchi (755) further discloses a stage mechanism, which carries thereon a mask used in a scan-type exposure apparatus using an electron beam. FIG. 1A is a top plan view of an X-Y stage, which operates within a vacuum chamber, and FIG. 1B is a section view taken along the line 1B--1B shown in FIG. 1A. An X stage 1 is a stage mechanism, which uses two air slide bearings as guides thereof and operates while maintaining the vacuum environment (for example, 10^{-7} Torr) of the interior portion of the vacuum chamber.

The X stage 1 comprises two slide shafts 3 respectively disposed so as to penetrate through the vacuum chamber 2, a stage base plate 4, two air slide bearings 5, bellows 6, an air servo cylinder 7 serving as an actuator, and a drive rod 8 connecting together the air servo cylinder 7 and stage base plate 4. Further, each of the two air slide bearings 5 includes, on the bearing surface thereof, air pads for floating up its associated slide shaft using compressed gas, exhaust grooves for discharging the compressed gas, and suction grooves for preventing the compressed gas from flowing into the vacuum chamber 2.

The two slide shafts 3a, 3b, which respectively penetrate through the vacuum chamber 2, are arranged in parallel to each other; and, each of the two slide shafts 3a, 3b is supported by two air slide bearings 5 which are disposed outside the vacuum chamber 2 and are arranged with the vacuum chamber 2 between them. Within the vacuum chamber 2, almost in the respective central portions of the two slide shafts 3a, 3b, there is mounted a stage base plate 4 in such a manner that the stage base plate 4 bridges over the central portions. In the central portion of the stage base plate 4,

there is opened up an opening 4a. This is a window through which there is guided an electron beam so that a mask (not shown) can be irradiated with the electron beam.

On the lower surface of the stage base plate 4, there is disposed a Y stage 20 (FIG. 1B). By the way, although, in the present embodiment, the Y stage 20 is disposed on the lower surface of the stage base plate 4, this is not limitative but the Y stage 20 can also be disposed on the upper surface of the stage base plate 4. The drive rod 8, which is mounted on the air servo cylinder 7, penetrates through the vacuum chamber 2 and is then mounted on the side surface central portion 4b of the stage base plate 4. The drive rod 8 is used to transmit the drive force of the air servo cylinder 7 to the stage base plate 4. On the penetration portion 2b of the vacuum chamber 2 and the opposed surface 7a of the air servo cylinder 7 that is opposed to the penetration portion 2b, there is mounted a bellows-like bellows 9. In the portion of the slide surface of the drive rod 8 of the air servo cylinder 7 that is located near to the bellows 9, there is formed a suction groove (not shown) which is used to discharge the air. Cooperative action between the bellows 9 and suction groove prevents the air from leaking from the penetration portion 2b, thereby being able to keep the vacuum of the interior portion of the vacuum chamber 2.

The Y stage 20 is guided by cross rollers 21 which serve as rolling guides, and is driven by an ultrasonic motor 22 serving as an actuator. In the present embodiment, the scan direction of the stage requiring high speed and high acceleration in a scan-type exposure apparatus using an electron beam is considered as the X axis, while the step direction of the stage is considered as the Y axis.

Higuchi (755) also discloses in FIG. 2 an exploded perspective view of an air slide bearing 5 employed in the present embodiment. In the present embodiment, the cross section of the slide shaft 3 and the cross section of an opening formed in the air slide bearing 5 are formed rectangular or square. The reason for this is that the rectangular or square shape can enhance the rigidity of the slide shafts 3 and can facilitate the manufacture of the air slide bearings 5, of course, the cross section of the slide shaft 3 and the cross section of the opening in the air slide bearing 5 can also be formed circular.

Each of the air slide bearings 5 is composed of four plates. In FIG. 2, there are shown a bottom plate 30 and only part of a side plate 31. In FIG. 2, this side is the direction of the penetration portions 2a of the vacuum chamber 2. On the slide surfaces of the respective plates with respect to the slide shaft, there are formed groups of air pads 32, suction grooves 33 arranged so as to surround the air pads 32 and air pad groups, and two suction grooves 34, 35 interposed between the air pad groups and the opposed surface 5a of the air slide bearing 5 that is opposed to the vacuum chamber 2.

Each air pad 32 is composed of a four-blocks-shaped groove 32a and, an orifice 32b which is situated in the center of the four-blocks-shape and is used to supply the air of a given pressure to the groove 32a; and, the air pad 32 floats up the slide shaft 3 using the air. On each of the slide surfaces of the bottom plate 30 and remaining

plates, there are disposed the air pads 32 in two lines and four rows, a total of eight air pads 32. See Column 10, line 1-30.

Higuchi further discloses that although the stage mechanism is used inside the vacuum chamber, it can be guided in a non-contact manner, there can be eliminated the vibrations thereof when it is driven, and thus the running performance thereof including straightness deviation, Yaw, Roll and Pitch can be maintained at high accuracy for a long period of time. See Column 13, line 65-67; and Column 14, line 1-4.

Higuchi (755) does not disclose the use of a coil and magnetic track structure. However, Lo (705) discloses in FIG. 3 a cross section view along A--A of stage 100 of FIG. 2. An objective lens 111 of the electron beam microscope positioned directly over rotary table 110 is also shown. The magnetic motors 112a/b are integrated into stage 100 such that their interference with objective lens 111 (both the lens and the beam) is minimized. Each of magnetic motors 112a/b includes a magnet track assembly 106 enclosed by a housing 105, and a cooperating motor coil assembly 115 covered by a coil shield 104.

Unlike conventional designs wherein the motor coil assembly is stationary and the magnet track assembly moves, magnet track assembly 106 along with its housing 105 are bolted to base 113, and are thereby stationary. If motor magnet track assembly 106 with its array of strong magnets were allowed to move, the magnetic field strength at the beam position would fluctuate and induce beam drift. Also, a moving housing 105 can interfere with the optical properties of a magnetic objective

lens, especially the immersion type lens that spills a strong magnetic field over the stage. Note that magnet track assembly 106 is bolted to base 113 such that its end opening, which receives motor coil assembly 115, points away from objective lens 111, thereby reducing its magnetic field interference with the beam. See Column 6, line 12-43.

Therefore it would have been obvious to one of ordinary skill in the art that the lithography stage mechanism of Higuchi (755) can be modified to use the coil and magnetic track structure in accordance with Lo (705), to drive the x and y platforms of the stage, thereby providing minimal vibration and particle generation, while providing high speed and torque.

Higuchi (755) in view of Lo (705) does not disclose the use of plural guide beams with air bearing structures in fluid communication with a first and second vacuum chamber. Trost (925); however, discloses a vacuum compatible linear motion device for lithography that includes a flexible bellows 37 having an essentially circular cross-section with a diameter sufficiently large to accommodate the full extent of linear motion required along axis 44 and is vacuum coupled at one end to chamber element 10 and at the other end to plate 70. Essentially circular orifices (not shown) with a diameter approximately equal that of bellows 37 are provided in chamber element 10 and plate 70 where coupled to bellows 37. In this manner, linear motion along axis 44 is not restricted while maintaining vacuum within bellows 37 (the vacuum coupling of the ends of flexible bellows 37 is not shown due to the perspective view of FIG. 1).

Linear motion along axis 54 is accommodated through the compression or extension of bellows 37.

Also as shown in FIG. 2, device 100 is fully contained within a vacuum chamber (not shown) and includes three main assemblies, a vacuum enclosure 130, a fluid bearing 150 and a force generating device (FGD) 210. Vacuum enclosure 130 includes a pair of flexible bellows 132, a rigid coupling 134 and a pair of rigid mounting plates 120. Each of the pair of flexible bellows 132 is coupled at one end to one of the pair of rigid mounting plates 120 and at another end to rigid coupling 134. A vacuum port 110 provides a means of evacuating enclosure 130 to a pressure below that of atmospheric pressure. Rigid mounting plates 120 are plates specifically designed to provide vacuum closure for ends of bellows 132, and as discussed below, mounting of bearing rod 152. Alternately, mounting plates 120 are interior surfaces of the vacuum chamber within which vacuum enclosure 130 is contained. See Column 2, line 6-18; and Column 4, line 1-16.

Therefore it would have been obvious to one of ordinary skill in the art that the lithography stage mechanism of Higuchi (755) in view of Lo (705), can be modified to use flexible bellows apparatus of Trost (925) to provide vacuum enclosures for the slide mechanism, thereby preserving the vacuum environment of the interior portion of the vacuum chamber and thus maintaining a clean environment.

Conclusion

3. Any inquiry concerning this communication or earlier communications should be directed to Phillip Johnston whose telephone number is (703) 305-7022. The examiner can normally be reached on Monday-Friday from 7:30 am to 4:00 pm. If attempts to reach the examiner by telephone are unsuccessful, the examiners supervisor John Lee can be reached at (703) 308-4116. The fax phone numbers are (703) 872-9318 for regular response activity, and (703) 872-9319 for after-final responses. In addition the customer service fax number is (703) 872- 9317.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703 308 0956.

PJ

August 15, 2003

BRUCE ANDERSON
PRIMARY EXAMINER